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A COMPARISON OF NASOGASTRIC AND NASOJEJUNAL ROUTES OF FEEDING IN THE ENTERAL NUTRITION OF SEVERE ACUTE PANCREATITIS

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ABSTRACT **Background:** Though multiple RCTs and meta-analyses indicate nasogastric nutrition to be effective and safe in the enteral nutrition of severe acute pancreatitis, this route is potentially against to the requirement of pancreatic rest in the acute inflammation phase. Hence, the present study has been carried out at a tertiary care centre to compare nasogastric with the nasojejunal mode of enteral nutrition, and evaluate the impact of the mode of feeding on nutritional parameters, complications and outcomes. **Methodology:** This prospective comparitive study was done at Gandhi Hospital, Secunderabad over a period of 2 years, wherein included patients (total n = 34) with severe acute pancreatitis were randomised and provided enteral nutrition by either Nasogastric or nasojejunal routes. They were then evaluated regarding the impact on nutritional parameters, complications and outcomes, to compare the impact of Nasogastric vs Nasojejunal modes of feeding. **Observations and Results:** There was no statistically significant difference in the change in nutritional parameters, or in the side effect profile on comparing the patients in the nasogastric vs the nasojejunal mode of feeding. The outcomes such a Length of Hospital stay, local and systemic complications, development of Multiorgan failure, need for surgery and therapeutic endoscopic interventions, as well as the Mortality rates were statistically similar between both groups. **Conclusion:** Hence, this study demonstrates that the NG route of enteral nutrition is statistically comparable to NJ route of enteral nutrition in severe acute pancreatitis, as both have similar outcomes and tolerance. Thus when NJ tube placement is not feasible, NG tube route of feeding may be provided for patients with severe acute pancreatitis.

KEYWORDS :

INTRODUCTION

EN within 48 h of admission improved the clinical outcomes of Severe Acute Pancreatitis by decreasing complications such as infection and organ failure. [1] Nasojejunal is the established route of enteral nutrition. Jejunal feeding does not stimulate pancreatic exocrine secretion.[2] Many studies indicate that delivery of nutrients proximal to the duodeno-jejunal flexure will cause release of cholecystokinin (CCK), and an exacerbation of the inflammatory process in the pancreas, as a result of stimulation of exocrine pancreatic secretion.[3] Various animal and human studies [4, 5] have shown an increase in exocrine pancreatic secretion in response to enteral feeding, with a greater response to intragastric feeding.

However, none of these studies were carried out in acute pancreatitis (AP) where animal studies have shown that pancreatic exocrine secretion, in response to CCK stimulation, is suppressed. [6] In addition, it is known that neural pathways affect pancreatic secretion and the presence of nutrients in the jejunum causes significant CCK release. [7] The delivery of enteral feed distal to the ligament of Treitz does not prevent duodenal exposure to nutrients, as a degree of reflux is inevitable.[7] Moreover, NJ route of enteral feeding has certain disadvantages. The reliable placement of a NJ tube involves either siting at endoscopy or under radiographic screening, exposing the critically ill patient to the inherent risks of intrahospital transfer and delaying introduction of feeding. [8] In addition, the risk of duodenoscopy is greater in a sick patient, and potentially poses logistical problems for the radiology and/or endoscopy services, as tubes require more frequent readjustment. [9]

Nasogastric (NG) feeding is safe in the critically ill, ventilated patient.[10] Nasogastric enteral nutrition has been considered in the management of Severe Acute Pancreatitis as it is simple, easy to establish as it does not need fluoroscopy or endoscopy and is cost effective for the patient. Multiple RCTs and meta-analyses indicate nasogastric nutrition to be effective and safe.[11,12, 13, 14] However, this is potentially against to the requirement of pancreatic rest in the acute inflammation phase. Therefore, before recommendation of nasogastric enteral nutrition to clinical practice, further randomized controlled trials are needed. [15]

Hence, the present study has been carried out at Gandhi Medical College Hospital, a tertiary care centre to compare nasogastric with the nasojejunal mode of enteral nutrition in order to evaluate the impact on nutritional parameters, complications and outcomes.

AIMS AND OBJECTIVES OF THE STUDY:

- To compare the Outcomes of Nasogastric feeding and nasojejunal feeding routes of enteral nutrition in patients with severe acute pancreatitis – Length of hospital stay, Local and Systemic Complications, requirement for Surgery/ Endoscopic Interventions, Infections, Multiorgan failure and Mortality.
- To compare side-effect profiles of nasogastric and nasojejunal routes of enteral nutrition: Vomiting, Diarrhea, Exacerbation of Pain, and Dislodgment of tube.
- To compare changes in the following nutritional parameters after 1 week of enteral feeding: Body Mass Index (BMI), Mid-Arm Circumference (MAC), and Serum Albumin.

MATERIALS AND METHODS:

Inclusion Criteria:

Adult patients (18 years and above) diagnosed with Severe Acute Pancreatitis according to the revised Atlanta Classification (2012) admitted to the Gandhi Hospital, Secunderabad from November 2013 to November 2015 were included. Informed written consent was obtained from every patient. The study was performed after ethical clearance was obtained from the Institutional Ethical Committee.

EXCLUSION CRITERIA:

(a) age < 18
(b) a delay between onset of symptoms and presentation to hospital greater than 1 week
(c) Patients already taking oral feeds at presentation
(d) Patients with an acute exacerbation of chronic pancreatitis
(e) Pregnant patients
(f) Patients who underwent surgical intervention for infected pancreatic necrosis or pancreatic hemorrhage
(g) Patients with Pancreatic neoplasm,
(h) Patients with post ERCP pancreatitis or post traumatic etiology
(I) Patients unwilling to give consent to participate in the study

After inclusion, detailed evaluation of the patient and investigations including biochemical studies, radiological examinations of chest & abdomen and Ultrasonography were done. CT scan where indicated was performed. Alcoholic AP was defined when patients had a history

of alcohol consumption within 48 h before symptom onset with no signs of other possible causes.[22] Biliary pancreatitis was defined when there was a gallstone or biliary sludge on ultrasonogram or CT.[22] The etiology of SAP was labeled as "Other" in patients of all other etiologies who did not fit into either Alcohol or Biliary definitions of pancreatitis. The Baseline nutritional parameters recorded included anthropometric and biochemical measurements such as Body Mass Index, Mid Upper Arm Circumference and Serum Albumin Levels.

In the Second Phase, the patients were randomised to receive either Nasogastric or Nasojejunal tube feeding, based on computer generated random numbers. The feeding tubes were placed in the stomach and jejunum under fluoroscopic guidance through the nasal route.

The diets in the two groups were similar in caloric, lipid and protein content. A semi-elemental enteral formula was used, given as a slow infusion at a rate of 1-1.5 ml/min through the enteral tube in both groups. Feeding was started with intake of 250 Kcal/day to reach a target level of 1800 kcal/day. Increase of the caloric intake from 250 Kcal/day to 1800 Kcal/day was over a 72 hour period and as tolerated. If a patient is unable to tolerate the prescribed rate of enteral feeding, the rate was reduced by 50% and gradually increased again when tolerated. The tube feeding was continued until a minimum period of 7 days or longer; the tube was removed when patients started taking oral feeds, depending on tolerance to oral feeding. Intravenous fluids such as crystalloids or colloids were added in both groups to fulfill the individual's needs of fluids and energy. Regular hospital diet was introduced initially starting with liquid followed by solid food.

Feeding was stopped before day 7 in case of feeding pain and persistent paralytic ileus. Feeding pain is defined as occurrence of pain requiring stoppage of feeding, associated with elevation of serum amylase levels to at least twice the previous value. Abdominal discomfort is not considered to be pain relapse. Patients were monitored daily for tolerance to feed (Gastro Intestinal symptoms like nausea, vomiting, diarrhoea, abdominal discomfort, pain and Systemic symptoms like sweating and palpitations). Pain was assessed by using Visual Analog Scale (VAS) at rest. The nutritional parameters would be repeated at the end of seven days. Additionally, other combined treatments included gastrointestinal decompression, prophylactic antibiotics, fluid management, artificial ventilation or renal replacement therapy for MODS, ERCP with endoscopic sphincterotomy for selected biliary patients, and surgery when indicated.

In the third phase, patients were monitored from the completion of the study period until the endpoint of the study which includes discharge from hospital, surgery or death. Local complications include acute peripancreatic fluid collections, pancreatic pseudocyst, acute necrotic collection and walled-off necrosis, and splenic or portal vein thrombosis. Outcomes recorded were tolerance to feeding, exacerbation of pain, length of hospital stay, changes in biochemical parameters, surgical and endoscopic interventions, complications and their management, development of Multi-organ failure and mortality.

STATISTICAL METHODS:

- Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters.
- Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

STATISTICAL SOFTWARE:

The Statistical software namely SPSS 23.0 and Java Stat, were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc

OBSERVATIONS AND RESULTS:

This study is a prospective comparative study. A total of 34 patients with acute severe pancreatitis were included in the study. 16 patients were randomized to the nasogastric group and 18 patients were randomized to the nasojejunal group.

The Mean ± SD age of patients in the NG group is 39.44 ± 11.36 years and the Mean ± SD age of patients in the NJ group is 37.06 ± 10.3 years. Total number of male patients was 26 (76.47 %) and total numbers of female patients were 8 (23.53 %). Numbers of male patients in the NG group were 12 (75 %), and the numbers of female patients were 4 (25 %). The numbers of male patients in the NJ group were 14 (77.78 %), and the numbers of female patients were 4 (22.22 %).

The etiology of pancreatitis in the patients was as follows: alcohol in 19 (55.89 %), biliary in 8 (23.52 %), and Other causes in 7 (20.58 %). The etiologies in the NG group were Alcohol in 9 patients, Biliary in 4 patients and other causes in 3 patients. The etiologies in the NJ group were in Alcohol in 10 patients, biliary in 4 patients, and Other etiologies in 4 patients. Other causes included Tropical Pancreatitis, Hypertriglyceridemia, Hyperparathyroidism and Idiopathic causes.

Table 1: Comparison of etiologies between the two groups

Etiology	Group NG (N = 16)		Group NJ (N = 18)		Total (N = 34)	
	Number	%	Number	%	Number	%
Alcohol	9	56.25	10	55.55	19	55.89
Biliary	4	25	4	22.22	8	23.52
Other	3	18.75	4	22.22	7	20.58

Table 2: Comparison of APACHE II score between the two groups

APACHE II SCORE	Group NG (N = 16)		Group NJ (N =18)		P value
	Number	%	Number	%	
8 to 9	5	31.25	9	50	P = 0.467
10 - 14	9	56.25	7	38.89	
15 - 19	1	6.25	2	11.11	
20 - 24	1	6.25	0	0	
Total	16	100	18	100	
Mean ± SD	11.19 ± 3.229		10.44	± 2.662	

All the included patients had severe acute pancreatitis, with APACHE II scores Mean ± SD of 11.19 ± 3.229 in the NG group and 10.44 ± 2.662 in the NJ group. There was no statistically significant difference in severity of pancreatitis between both groups with a p value of 0.467. Organ failure was present in all 34 patients as defined by modified Marshall Score of greater than or equal to 2. 16 Respiratory failure was the most common organ failure and was seen in 43.75 % of NG patients and 50 % of NJ patients.

Table 3: Comparison of Organ Failure (%) between the two groups

Organ Failure Modified MARSHALL SCORE ≥ 2	Group NG(N = 16)		Group NJ(N = 18)	
	Numbers	%	Numbers	%
Respiratory	7	43.75	9	50
Cardiovascular	4	25	4	22.22
Renal	5	31.25	5	27.78

Nutritional (BMI, Mid Arm Circumference) and Biochemical parameters (Serum Albumin) were measured at baseline, and again after 1 week of enteral nutrition. All parameters had decreased from the baseline. However the decrease were comparable in both NG and NJ groups and there was no statistically significant difference in both groups. The Mean ± SD of BMI at baseline in NG group was 23.62 ± 2.174 in NG group and 23.84 ± 1.907 in the NJ group. The Mean ± SD of BMI after 1 week of enteral nutrition was 23.06 ± 2.152 in NG group and 23.33 ± 1.775 in the NJ group. The Mean ± SD of Mid arm circumference at baseline was 26.83 ± 2.371 in NG group and 27.35 ± 2.119 in NJ group. The Mean ± SD after 1 week of enteral nutrition was 25.59 ± 2.399 in NG group and 25.98 ± 2.105 in the NJ group.

The Mean ± SD at baseline of Serum Albumin in NG group was 3.081 ± 0.3674, and was 3.139 ± 0.322 in NJ group. The Mean ± SD after 1 week of enteral nutrition was 2.919 ± 0.327 in NG group and was 2.9 ± 0.2744 in NJ group.

Various side-effects related to feeding included vomiting, exacerbation of pain, Tube displacement, and Diarrhea. Diarrhea was the most common side-effect and occurred in 25% of NG and 27.7 NJ patients. Exacerbation of pain, Vomiting, and tube displacement were each present in 12.5 % of NG patients and 5.5 % of NJ patients. However, there was no statistically significant difference in any of these side-effect rates between the NG and the NJ groups.

Table 4: Complication/ Side-effects that occurred in present study

COMPLICATIONS	Group NG (N = 16)	Group NJ (N = 18)	Total	P value
Vomiting	2 (12.5 %)	1 (5.5 %)	3 (8.8 %)	0.476
Exacerbation of Pain	2 (12.5 %)	1 (5.5 %)	3 (8.8 %)	0.476
TubeDisplacement/Removal	2 (12.5 %)	1 (5.5 %)	3 (8.8 %)	0.476
Diarrhea	4 (25 %)	5 (27.7 %)	9 (26.5 %)	0.854
Infection	4 (25 %)	4 (22.2 %)	8 (23.5 %)	0.848

11) There was no significant difference in Infective complications, which were present in 25% of NG and 22.2 % of NJ patients.

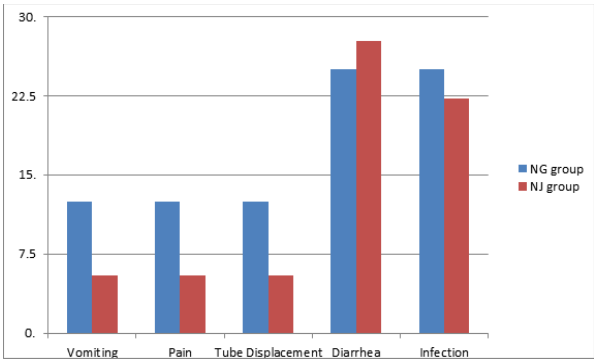

Figure 1: A comparison of side-effects in NG Group and NJ groups

Local complications included fluid collections, pseudocysts, acute necrotic collections and Walled of pancreatic necrosis [16]. There was 1 incidence of portal vein thrombosis and 1 patient had splenic vein thrombosis. Local complications developed in 7 patients in the NG Group (43.75 %), and 8 patients (44.44 %) in the NJ group.

Systemic complications developed in 3 patients (18.75%) in NG group and 2 patients (11.11%) in NJ group. They included exacerbations of pre-existing Coronary artery disease in 2 patients, exacerbation of COPD in 1 patient , exacerbation of asthma in 1 patient, and deterioration of Chronic kidney disease in 1 patient . There was no statistically significant difference (p= 0.5) in outcomes between both groups.

A total of 11 patients (32.35 %) developed Multiorgan failure. Multisystem organ failure is defined as 2 or more organs failing on the same day, rather than 1 organ failing on 1 day and another failing on the subsequent day. [16] Involvement of more than one systems among the Respiratory, Cardiovascular, and the Renal organ systems were considered for defining MOF, according to Modified Marshall scoring system. [17] The most common MOF was a combination of Respiratory and Cardiovascular failure seen in 4 patients. 5 patient in the NG group (31.25 %) and 6 patients in the NJ group (33.33 %) developed MOF. There was no statistically significant difference in MOF between both groups.

On follow-up during the hospital stay, 4 patients (25 %) in the NG group and 4 patients (22.22 %) in the NJ group underwent surgery or endoscopic interventions. The interventions included Necrosectomy, Cystogastrostomy, Surgical drainage of pseudocyst, therapeutic ERCP, and Cholecystectomy. There was no statistically significant difference in the incidence of surgery between both groups.

Table 5: Comparison of Surgery and Endoscopic Interventions between two groups

INTERVENTION	NG group (N = 16)	NJ group (N = 18)
ERCP	2	1
Necrosectomy	1	1
Cystogastrostomy	1	1
Necrosectomy + Surgical drainage of pseudocyst + Cholecystectomy	0	1
Total	4	4
INFERENCE: The P value between the overall surgical outcomes of both the groups calculated to be 0.848 (non-significant)		

The total overall Mortality was 9 patients (26.47 %); 4 patients (25 %) in the NG group and 5 patients (27.77 %) in the NJ group. However the mortality was not statistically different between the two groups, with a P value of 0.854.

Table 6: Multiorgan failure distribution

MOF - Involved systems	Total Number of patients
Respiratory + Cardiovascular	4
Respiratory + Renal	3
Cardiovascular + Renal	1
All 3 systems	3

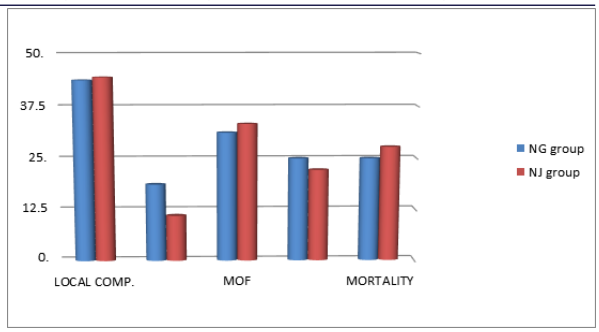

Figure 2: Comparison of outcomes between two groups

DISCUSSION

The sample size is similar to a study conducted by Kumar et al [12] in 2006, wherein the sample size is 31 with 15 patients in the NG arm and 16 patients in the NJ arm. The sample size is also similar to a study done in 2010 by Piciucchi et al [20] which had a total sample size of 25; The sample sizes were higher in studies by Eatock[13] with 50 patients and by Singh et al [21] done in 2012 which had a total sample size of 78. Alcohol was the most common etiology in the present study similar to studies conducted by Kumar et al [12], and Singh et al [21]

When compared to the baseline, there was a decrease in nutritional parameters such as BMI, MAC and serum Albumin after 1 week. However the modality of feeding ie. NG vs NJ made no statistical significant difference in the decline of the nutritional parameters. Similar results were also noted in studies by Kumar et al [21] done in 2006.

Table 7: Present Study: MAC at baseline and after 1 week of enteral nutrition

Nutritional Parameters	Group NG (N = 16)	Group NJ (N = 18)	P value
MAC baseline (cm) (Mean ± SD)	26.83 ± 2.371	27.35 ± 2.119	0.505
MAC after 1 week of EN (cm) (Mean ± SD)	25.59 ± 2.399	25.98 ± 2.105	0.611

Table 8: Comparison of Mid Arm Circumference with Kumar et al [12] (2006)

Nutritional Parameters	Group NG (N = 16)	Group NJ (N = 14)	P value
MAC baseline (cm) (Mean ± SD)	26.93 ± 2.26	27.98 ± 3.70	0.336
MAC after 1 week of EN (cm) (Mean ± SD)	26.71 ± 2.01	26.62 ± 4.05	0. 946

On comparing side effects with other studies, Vomiting, Infection and Exacerbation of pain were higher in the NG group whereas Diarrhoea and Tube displacement were higher in NJ group. This was similar to findings by Piciucchi et al [20] , Singh et al [21] , Eatock [13], Kumar et al [12] . However the P value was not significant in present study as well the above studies.

Table 9: Comparison of side-effects with other studies

COMPLICATIONS	Study	Group NG (%)	Group NJ (%)	P
Vomiting	Present study	12.5	5.5	0.476
	Piciucchi et al [20]	13.3	10	1
Exacerbation of Pain	Present study	12.5	5.5	0.476
	Kumar et al [12]	6.25	7.14	1
	Eatock [13]	7.4	0	-
	Piciucchi et al [20]	33.3	20	0.68
	Singh [21]	7.6	12.82	0.60
Tube Displacement	Present study	12.5	5.5	0.476
	Kumar et al [12]	6.3	7.14	-
	Piciucchi et al	0	10	0.4
Diarrhea	Present study	25	27.7	0.854
	Kumar et al [12]	25	21.42	-
	Eatock [13]	11.11	4.54	-
	Piciucchi et al [20]	33.3	30	1

	Singh [21]	10.2	7.69	-
Infection	Present study	25	22.2	0.848
	Kumar et al [12]	37.5	42.85	0.467
	Piciucchi et al [20]	20	10	1
	Singh [21]	23.1	35.9	0.64

Table 10: Comparison of Surgery/ Interventions with other studies

OUTCOMES	Study	Parameter	Group NG	Group NJ	P value
Surgery/ Interventions	Present Study	Patients (percentage)	4 (25 %)	4 (22.22)	0.848
	Eatock [13]	Patients (percentage)	7 (25.9)	9 (39.1)	-
	Kumar et al [12]	Patients (percentage)	1 (6.25)	2 (14.28)	0.761
	Piciucchi et al [20]	Patients (percentage)	0	0	-

Though statistically non-significant, the need for surgery/ Interventions was higher in the NJ group in the present study as well as studies by Eatock [13] , Kumar et al [12] .

MOF was higher in the NJ group in the present study as well as studies by Kumar et al [12] , Singh et al [21] , and in a meta- analyses by Chang et al [23] . However in the study by Piciucchi et al [20] , the MOF was higher in the NG group. The differences however were statistically insignificant, suggesting that MOF was unaffected by either the NG or the NJ modality of feeding.

Table 11: Comparison of Multiorgan Failure (MOF) with other studies

OUTCOMES	Study	Parameter	Group NG	Group NJ	P value
Multiorgan failure (MOF)	Present Study	Patients (percentage)	5 (31.25)	6 (33.33 %)	0.896
	Kumar et al [12]	Patients (percentage)	2 (18.8)	3 (21.42)	0.354
	Piciucchi et al [20]	Patients (percentage)	4 (26.6)	1 (10)	0.6
	Singh et al [21]	Patients (percentage)	11 (28.1)	15 (38.3%)	0.174
	Chang et al Meta-analysis [23]	Patients (percentage)	14 (17.07)	18 (24)	0.28

Table 12: Comparison of Outcomes with other studies

OUTCOMES	Study	Parameter	Group NG	Group NJ	P
Length of Stay (LOS)	Present Study	Mean ± SD	17.13 ± 4.911	18.44 ± 5.227	0.455
	Kumar et al [12]	Mean ± SD	24.06 ± 14.35	29.93 ± 25.54	0.437
	Piciucchi et al [20]	(Mean 95 % CI)	30.6 (18.1 -43)	21.2 (17.7 - 24.6)	0.1
	Singh [21]	Median (range)	17 (1 -73)	18 (4- 54)	0.438
	Eatock [13] 2005	Median (range)	16 (10 -22)	15 (10 -42)	-
	Eatock [13] 2005	Patients (Percentage)	5 (18.51)	7 (31.81)	
	Chang Meta-analyses [23]	Patients (Percentage)	14 (17.07)	18 (24)	0.25

Length of Hospital stay was similar in both groups with a Mean ± SD of 17.13 ± 4.911 in NG group and 1 8.44 ± 5.227 in the NJ group.Length of hospital stay was not statistically significantly affected by the modality of feeds. However the LOS was higher in the NJ group in the present study as well as study by Kumar et al [12] . LOS was non-significantly higher in the NG group In studies by Eatock [13] , Singh [21] , and Piciucci [20] .

Table 13: Comparison of Mortality with other studies

OUTCOMES	Study	Parameter	Group NG	Group NJ	P
Mortality	Present Study	Patients (Percentage)	4 (25 %)	5 (27.77 %)	0.854
	Kumar et al [12]	Patients (Percentage)	5 (31.25)	4 (28.57)	0.761
	Singh et al [21]	Patients (Percentage)	4 (10.2)	7 (17.94)	

Mortality was noted to be higher in the NJ group in the present study, and similar results were obtained in studies by Singh [21] , Eatock [13] , and meta-analyses by Chang [23] . The mortality was higher in higher in the NG group in the study by Kumar et al [12] . However the P values were non- significant, suggestive of the fact that mortality was unaffected by the modality of feeding.

CONCLUSIONS

This study compared patients with similar demographic patterns (age and gender) and with similar severity scores of acute pancreatitis. Alcohol was the most common etiology for SAP in the present study (55.89%) overall. Enteral feeds were tolerated well by both NG and NJ groups, suggesting that Enteral Nutrition by NG is safe and can be used in patients with SAP. There was a non-significant decrease in nutritional and biochemical parameters after 1 week of enteral nutrition from the baseline in both groups. This probably occurred because the enteral calorie intake was inadequate and was increased from 250 Kcal to 1800 Kcal over 7 days according to the calculated requirements.

There were no major complications of feeding in the two groups. There were no statistically significant differences in side-effects of enteral feeding such as Diarrhea, vomiting, tube displacement and exacerbation of pain between both groups. There was no significant difference in Infective complications, which were present in 25% of NG and 22.2 % of NJ patients.

The outcomes such a Length of Hospital stay, local and systemic complications, development of Multiorgan failure, need for surgery and therapeutic endoscopic interventions as well as the Mortality rates were statistically similar between both groups.

Hence, this study demonstrates that the NG route of enteral nutrition is statistically comparable to NJ route of enteral nutrition in severe acute pancreatitis, as both have similar outcomes and tolerance. Thus when NJ tube placement is not feasible, NG tube route of feeding may be provided for patients with severe acute pancreatitis.

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